CLAIMS

What is claimed is:

1. A closed loop fluid pumping system to control a temperature of an electronic device, the system comprising:
   a. at least one pump;
   b. at least one heat exchanger coupled to the electronic device and configured to pass a fluid therethrough, wherein the fluid performs thermal exchange with the electronic device;
   c. at least one heat rejector; and
   d. fluid interconnect components to couple the at least one pump, the at least one heat exchanger and the at least one heat rejector,

   wherein the closed loop fluid pumping system loses up to a predetermined maximum amount of the fluid over a desired amount of operating time.

2. The hermetic closed loop fluid system according to claim 1 wherein the fluid is a single phase fluid.

3. The hermetic closed loop fluid system according to claim 1 wherein the fluid is a two phase fluid.

4. The hermetic closed loop fluid system according to claim 1 wherein the at least one pump is made of a material having a desired permeability.

5. The hermetic closed loop fluid system according to claim 4 wherein the at least one pump is made of a metal, a ceramic, a glass, a plastic, a metalized plastic, or any combination thereof.

6. The hermetic closed loop fluid system according to claim 1 wherein the fluid interconnect components are made of a material with a desired permeability.

7. The hermetic closed loop fluid system according to claim 6 wherein the fluid interconnect components are made of a metal, a ceramic, a glass, a plastic, a metalized plastic, or any combination thereof.

8. The hermetic closed loop fluid system according to claim 1 wherein the fluid interconnect components are coupled to the at least one pump, the at least one heat exchanger, and the at least one heat rejector by adhesives, solder, welds, brazes, or any combination thereof.

9. The hermetic closed loop fluid system according to claim 1 wherein the fluid interconnect components include a sealing collar configured to be positioned between the at least one pump, the at least one heat exchanger, or the at least one heat rejector and a fluid tube.

10. The hermetic closed loop fluid system according to claim 9 wherein the sealing collar includes a thermal expansion coefficient substantially similar to a thermal expansion coefficient of the at least one pump, the at least one heat exchanger, or the at least one heat rejector to which the sealing collar is coupled.

11. The hermetic closed loop fluid system according to claim 9 wherein the sealing collar includes a ductility characteristic to provide a sealed junction with the fluid tube.

12. The hermetic closed loop fluid system according to claim 9 wherein the sealing collar is sealably coupled to the at least one pump, the at least one heat exchanger, or the at least

one heat rejector and the fluid tube using compression fitting.

13. The hermetic closed loop fluid system according to claim 1 wherein the closed loop fluid pumping system losses less than 0.89 grams of fluid per year.

14. The hermetic closed loop fluid system according to claim 1 wherein the closed loop fluid pumping system losses less than 1.25 grams of fluid per year.

15. The hermetic closed loop fluid system according to claim 1 wherein the closed loop fluid pumping system losses less than 2.5 grams of fluid per year.

16. A closed loop fluid pumping system to control a temperature of an electronic device, the system comprising:
    a. at least one pump;
    b. at least one heat exchanger coupled to the electronic device and configured to pass a fluid therethrough, wherein the fluid performs thermal exchange with the electronic device;
    c. at least one heat rejector; and
    d. fluid interconnect components to couple the at least one pump, the at least one heat exchanger and the at least one heat rejector,

    wherein the closed loop fluid pumping system loses less than 0.89 grams of fluid per year.

17. The hermetic closed loop fluid system according to claim 16 wherein the fluid is a single phase fluid.

18. The hermetic closed loop fluid system according to claim 16 wherein the fluid is a two phase fluid.

19. The hermetic closed loop fluid system according to claim 16 wherein the at least one pump is made of a material having a desired permeability.

20. The hermetic closed loop fluid system according to claim 19 wherein the at least one pump is made of a metal, a ceramic, a glass, a plastic, a metalized plastic, or any combination thereof.

21. The hermetic closed loop fluid system according to claim 16 wherein the fluid interconnect components are made of a material with a desired permeability.

22. The hermetic closed loop fluid system according to claim 21 wherein the fluid interconnect components are made of a metal, a ceramic, a glass, a plastic, a metalized plastic, or any combination thereof.

23. The hermetic closed loop fluid system according to claim 16 wherein the fluid interconnect components are coupled to the at least one pump, the at least one heat exchanger, and the at least one heat rejector by adhesives, solder, welds, brazes, or any combination thereof.

24. The hermetic closed loop fluid system according to claim 16 wherein the fluid interconnect components include a sealing collar configured to be positioned between the at least one pump, the at least one heat exchanger, or the at least one heat rejector and a fluid tube.

25. The hermetic closed loop fluid system according to claim 24 wherein the sealing collar includes a thermal expansion coefficient substantially similar to a thermal expansion coefficient of the at least one pump, the at least one heat exchanger, or the at least one

heat rejector to which the sealing collar is coupled.

26. The hermetic closed loop fluid system according to claim 24 wherein the sealing collar includes a ductility characteristic to provide a sealed junction with the fluid tube.

27. The hermetic closed loop fluid system according to claim 24 wherein the sealing collar is sealably coupled to the at least one pump, the at least one heat exchanger, or the at least one heat rejector and the fluid tube using compression fitting.

28. A closed loop fluid pumping system to control a temperature of an electronic device, the system comprising:

a. at least one pump;

b. at least one heat exchanger coupled to the electronic device and configured to pass a fluid therethrough, wherein the fluid performs thermal exchange with the electronic device;

c. at least one heat rejector; and

d. fluid interconnect components to couple the at least one pump, the at least one heat exchanger and the at least one heat rejector,

wherein the closed loop fluid pumping system loses less than 1.25 grams of fluid per year.

29. The hermetic closed loop fluid system according to claim 28 wherein the fluid is a single phase fluid.

30. The hermetic closed loop fluid system according to claim 28 wherein the fluid is a two phase fluid.

31. The hermetic closed loop fluid system according to claim 28 wherein the at least one

pump is made of a material having a desired permeability.

32. The hermetic closed loop fluid system according to claim 31 wherein the at least one pump is made of a metal, a ceramic, a glass, a plastic, a metalized plastic, or any combination thereof.

33. The hermetic closed loop fluid system according to claim 28 wherein the fluid interconnect components are made of a material with a desired permeability.

34. The hermetic closed loop fluid system according to claim 33 wherein the fluid interconnect components are made of a metal, a ceramic, a glass, a plastic, a metalized plastic, or any combination thereof.

35. The hermetic closed loop fluid system according to claim 28 wherein the fluid interconnect components are coupled to the at least one pump, the at least one heat exchanger, and the at least one heat rejector by adhesives, solder, welds, brazes, or any combination thereof.

36. The hermetic closed loop fluid system according to claim 28 wherein the fluid interconnect components include a sealing collar configured to be positioned between the at least one pump, the at least one heat exchanger, or the at least one heat rejector and a fluid tube.

37. The hermetic closed loop fluid system according to claim 36 wherein the sealing collar includes a thermal expansion coefficient substantially similar to a thermal expansion coefficient of the at least one pump, the at least one heat exchanger, or the at least one heat rejector to which the sealing collar is coupled.

38. The hermetic closed loop fluid system according to claim 36 wherein the sealing collar includes a ductility characteristic to provide a sealed junction with the fluid tube.

39. The hermetic closed loop fluid system according to claim 36 wherein the sealing collar is sealably coupled to the at least one pump, the at least one heat exchanger, or the at least one heat rejector and the fluid tube using compression fitting.

40. A closed loop fluid pumping system to control a temperature of an electronic device, the system comprising:

a. at least one pump;

b. at least one heat exchanger coupled to the electronic device and configured to pass a fluid therethrough, wherein the fluid performs thermal exchange with the electronic device;

c. at least one heat rejector; and

d. fluid interconnect components to couple the at least one pump, the at least one heat exchanger and the at least one heat rejector,

wherein the closed loop fluid pumping system loses less than 2.5 grams of fluid per year.

41. The hermetic closed loop fluid system according to claim 40 wherein the fluid is a single phase fluid.

42. The hermetic closed loop fluid system according to claim 40 wherein the fluid is a two phase fluid.

43. The hermetic closed loop fluid system according to claim 40 wherein the at least one pump is made of a material having a desired permeability.

44. The hermetic closed loop fluid system according to claim 43 wherein the at least one

pump is made of a metal, a ceramic, a glass, a plastic, a metalized plastic, or any combination thereof.

45. The hermetic closed loop fluid system according to claim 40 wherein the fluid interconnect components are made of a material with a desired permeability.

46. The hermetic closed loop fluid system according to claim 45 wherein the fluid interconnect components are made of a metal, a ceramic, a glass, a plastic, a metalized plastic, or any combination thereof.

47. The hermetic closed loop fluid system according to claim 40 wherein the fluid interconnect components are coupled to the at least one pump, the at least one heat exchanger, and the at least one heat rejector by adhesives, solder, welds, brazes, or any combination thereof.

48. The hermetic closed loop fluid system according to claim 40 wherein the fluid interconnect components include a sealing collar configured to be positioned between the at least one pump, the at least one heat exchanger, or the at least one heat rejector and a fluid tube.

49. The hermetic closed loop fluid system according to claim 48 wherein the sealing collar includes a thermal expansion coefficient substantially similar to a thermal expansion coefficient of the at least one pump, the at least one heat exchanger, or the at least one heat rejector to which the sealing collar is coupled.

50. The hermetic closed loop fluid system according to claim 48 wherein the sealing collar includes a ductility characteristic to provide a sealed junction with the fluid tube.

51. The hermetic closed loop fluid system according to claim 48 wherein the sealing collar is sealably coupled to the at least one pump, the at least one heat exchanger, or the at least one heat rejector and the fluid tube using compression fitting.

52. A method of manufacturing a closed loop fluid pumping system to control the temperature of an electronic device, the method comprising:

a. forming at least one heat exchanger to be configured in contact with the electronic device and to pass a fluid therethrough, wherein the fluid performs thermal exchange with the electronic device;

b. forming at least one pump;

c. forming at least one heat rejector;

d. forming fluid interconnect components; and

e. coupling the at least one heat exchanger to the at least one pump and to the at least one heat rejector using the fluid interconnect components, thereby forming the closed loop fluid pumping system,

wherein the closed loop fluid pumping system is formed to loss less than a predetermined amount of the fluid over a desired amount of operating time.

53. The method according to claim 52 wherein the fluid is a single phase fluid.

54. The method according to claim 52 wherein the fluid is a two phase fluid.

55. The method according to claim 52 wherein the at least one pump is formed of a material having a desired permeability.

56. The method according to claim 55 wherein the at least one pump is formed of a metal, a ceramic, a glass, a plastic, a metalized plastic, or any combination thereof.

57. The method according to claim 52 wherein the fluid interconnect components are formed of a material having a desired permeability.

58. The method according to claim 57 wherein the fluid interconnect components are made of a metal, a ceramic, a glass, a plastic, a metalized plastic, or any combination thereof.

59. The method according to claim 52 wherein the fluid interconnect components are coupled to the at least one pump, the at least one heat exchanger, and the at least one heat rejector using adhesives, solder, welds, brazes, or any combination thereof.

60. The method according to claim 52 wherein the fluid interconnect components include a sealing collar configured to be positioned between the at least one pump, the at least one heat exchanger, or the at least one heat rejector and a fluid tube.

61. The method according to claim 60 wherein the sealing collar includes a thermal expansion coefficient substantially similar to a thermal expansion coefficient of the at least one pump, the at least one heat exchanger, or the at least one heat rejector to which the sealing collar is coupled.

62. The method according to claim 60 wherein the sealing collar includes a ductility characteristic to provide a sealed junction with the fluid tube.

63. The method according to claim 60 wherein the sealing collar is sealably coupled to the at least one pump, the at least one heat exchanger, or the at least one heat rejector and the fluid tube using compression fitting.

64. The method according to claim 52 wherein the closed loop fluid pumping system losses less than 0.89 grams of fluid per year.

65. The method according to claim 52 wherein the closed loop fluid pumping system losses less than 1.25 grams of fluid per year.

66. The method according to claim 52 wherein the closed loop fluid pumping system losses less than 2.5 grams of fluid per year.